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Economics of the Energy Industries

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For Nynke, who bore the costs,
and Arjen, Charles, and Hester, who expect some benefits

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PREFACE

This book is an introduction to the way economists analyze energy and to the central economic questions of each of the energy industries. The objective is to provide the reader with the background information, analysis, and vocabulary necessary for understanding the mass of specialized literature currently being published and the policy issues discussed almost daily in the news media.

The intended audience is the person who knows nothing about energy and knows only the basics of microeconomics as recalled from an economic principles course. Those who have more specialized knowledge of economics or some aspect of energy may also gain from the broader perspective offered here.

Part I provides the framework of economic concepts and gives an overview of the changes in energy markets since the turbulent 1970s. An underlying theme is the need to rely on the data that markets provide about human preferences when trying to analyze energy. Part II examines the extractive industries, beginning with the concepts of reserves and resources and the theory of optimal exploitation, and then moving on to consider the coal, oil, and natural gas industries. Part III deals with electricity, nuclear power, and various other sources of energy that have recently attracted attention. Finally, Part IV summarizes a number of the public policy questions raised by the energy industries. The objective throughout is to provide just enough detail so that the beginner can read more specialized studies and grasp their relationship to the larger picture.

Many people have helped me with this project. The East Ohio Gas Company provided funding to the Department of Economics of

Case Western Reserve University to permit me to initiate an Economics of Energy course. Case Western Reserve provided me with the sabbatical during which the first draft was written. My wife and children were very indulgent of my eccentricity in starting a third book while the first two were still in process. My colleagues were helpful and supportive; and Bela Gold (now of Claremont Graduate School) and Gerhard Rosegger shaped my views and approach during nearly two decades of collaboration. The enthusiasm of John Wierzbicki enabled me to deliver an early draft when my promises outran my energy. The secretarial staff of the economics department surmounted all obstacles to ensure that students received the text on time. I am indebted to David A. Huettner, James B. Lindberg, and John M. Peterson for many useful suggestions. Most of all, however, I want to thank the students who endured early versions of the course, improved two drafts of the text, and encouraged me to complete it.

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CHAPTER ONE

Energy: An Economist's View

THE GREAT ENERGY CRISIS

Shortages, rapidly rising prices, and talk about an energy crisis focused public attention on energy issues during the 1970s. The shortages during the fall of 1973 were the most dramatic symptoms of trouble in the petroleum markets; Americans are not used to waiting in line for an hour to buy *any* commodity. Not many months earlier, dealers had tried to attract customers by giving away maps, glassware, or other gifts. In 1973, however, the daily news carried pictures of lines stretching around the block, reports of shouting, fighting, and even killings in the waiting lines. Interviews featured people whose daily lives were completely disrupted by the inability to buy the gasoline they needed to reach work, home, school, or play.

The shortages were short-lived. The gasoline lines ended even before the Arab nations resumed shipments to the United States, although they recurred in 1979 when production fell in Iran. Never-

theless, much of the decade seemed to be characterized by reports, fears, memories, or forecasts of shortages of natural gas, fuel oil, gasoline, or electricity.

Although fear of shortage was more common than shortage itself, prices certainly showed conclusively that the markets for energy had changed in the 1970s. Figure 1.1 shows the behavior of some of the energy prices confronted by ordinary consumers. The price of natural gas increased at about the same rate as the Consumer Price Index (CPI) from 1950 to 1967, and the prices of fuel oil, gasoline, and electricity were even more stable. After 1973 all four of the energy prices increased rapidly. By 1981, when the CPI stood at 272 percent of the 1967 level, electricity came close to matching that at 267 percent, gas stood at 385 percent, fuel oil was 656 percent, and gasoline was 395 percent. These increases in the prices paid by a typical household were shocking because of both their magnitude and the publicity that OPEC (the Organization of Petroleum Exporting Countries) received. The amount and the timing of the price increases for various fuels differed because of such special characteristics as taxes, price controls, and the importance of fixed costs

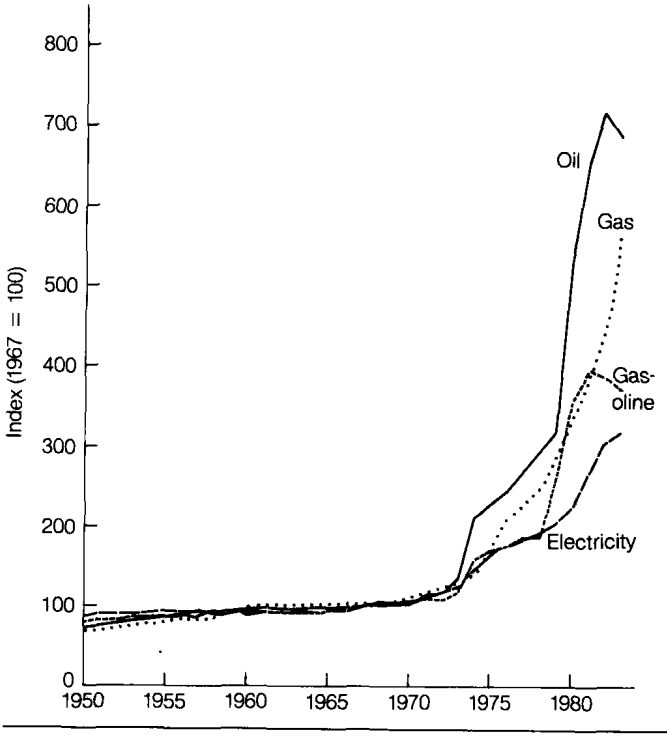

Figure 1.1 *U.S. Retail Price Indexes of Electricity, Gas, Oil, and Gasoline, 1950–1983*

Sources: U.S. Historical Statistics *(1975), p. 214; U.S. Department of Energy,* Annual Report *(1981), vol. 2, p. 95;* Monthly Labor Review *(various issues).*

and labor costs to the total cost of the industry. Despite such differences, however, wherever consumers turned they saw energy prices rising fast in the 1970s.

Before 1970 most people complacently assumed that electricity, gasoline, heating oil, and natural gas would be readily available at prices that yearly became less burdensome. Occasional power failures and shortages aroused irate disbelief from a public thoroughly conditioned to expect utmost reliability. Indeed, the substitution of mechanical and electrical devices for human effort was considered a symbol of economic progress. Furthermore, the assumption that energy prices would remain low was reflected in the design of cars and buildings.

Events of the 1970s popularized the gloomy forecasts that had once been restricted to an eccentric minority.[1] People waiting in line for gasoline, out of work because industrial plants were ordered to stop using natural gas, or shivering at home because oil was so expensive found it easy to believe that the age of plenty had ended. The eccentrics now seemed to be that small minority who argued that the shortages resulted from stupid government policy, not the niggardliness of nature.

Yet gradually the shortages eased. Even the coldest winter in a century in the Northeast produced only minor disruptions in 1980–81. Had the crisis that was supposed to herald the end of our civilization vanished? Did government policy suddenly become effective and intelligent? Had nature provided us with additional resources?

The most striking change after the shortages and fears ended was the new alignment of prices. Energy had become more expensive during the decade, dashing the dreams of unbounded supplies of cheap energy that had been inspired by vast reserves of cheap oil in the Middle East and by optimistic forecasts of the future of nuclear power. People are still adjusting to the new energy prices. Smaller cars and tighter houses are only the most obvious changes by consumers. Businesses are making equivalent improvements in insulation and motors. The more subtle and complex adjustments in industrial processes, location of economic activity, and choice of products are just beginning.

People have responded to high energy prices by trying to produce more energy, as well as by dimming the lights and turning down the heat. The number of crews exploring for oil in the United States and the rest of the world outside OPEC increased dramatically after prices rose.[2] The effort to increase non-OPEC production was successful, as the data in Chapter 9 show. Some users of oil responded to the high OPEC prices by shifting to cheaper fuels. The increased demand raised the prices of such fuels as well. Suppliers responded by searching for natural gas and developing more coal